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# PSF Analysis of DES Commissioning Data

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# Data Set

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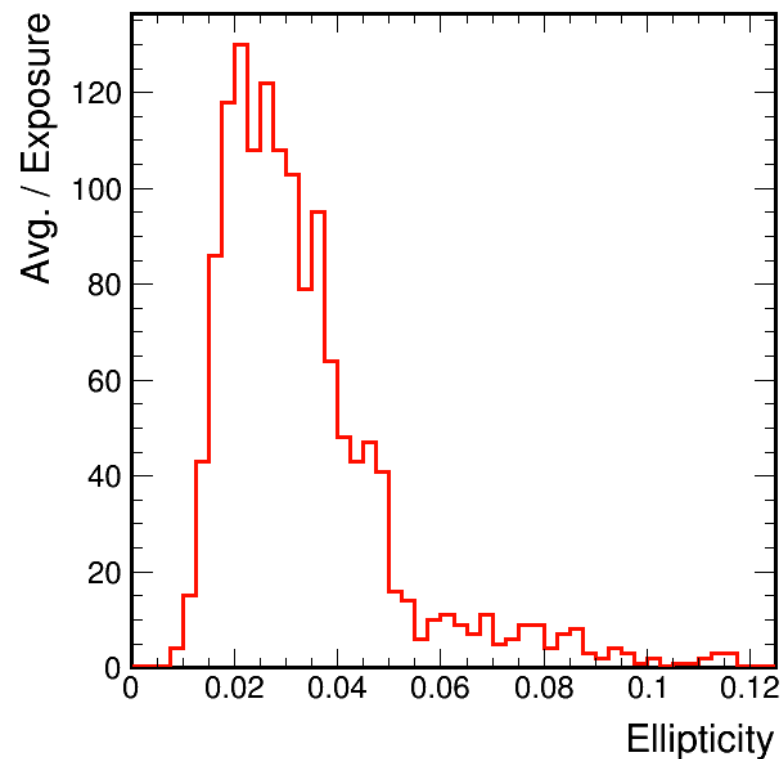
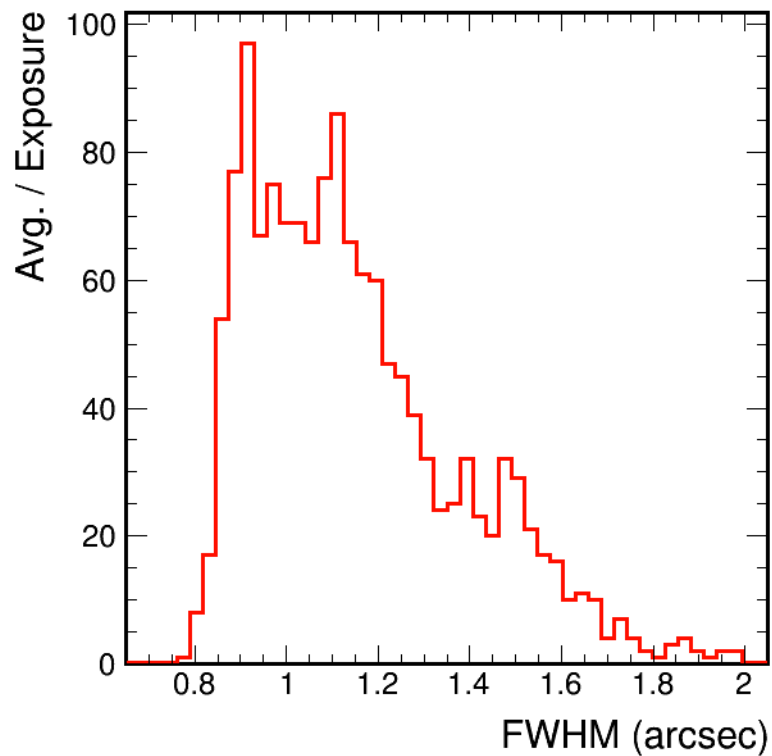
- DES commissioning data comprises  $\sim 150 \text{ deg}^2$  in grizY to a depth of  $\sim 24$ .
- I will show results from  $\sim 1300$  different exposures in i and z band over the contiguous region.
- We want to validate the PSF model and show that it is accurate enough to do weak lensing science.
- These preliminary results are from a shapelet based code largely developed by Mike Jarvis.



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# Data Quality

- Typical exposure - 1.1" and 0.03 ellipticity
- Significantly improved seeing in Year 1 data.

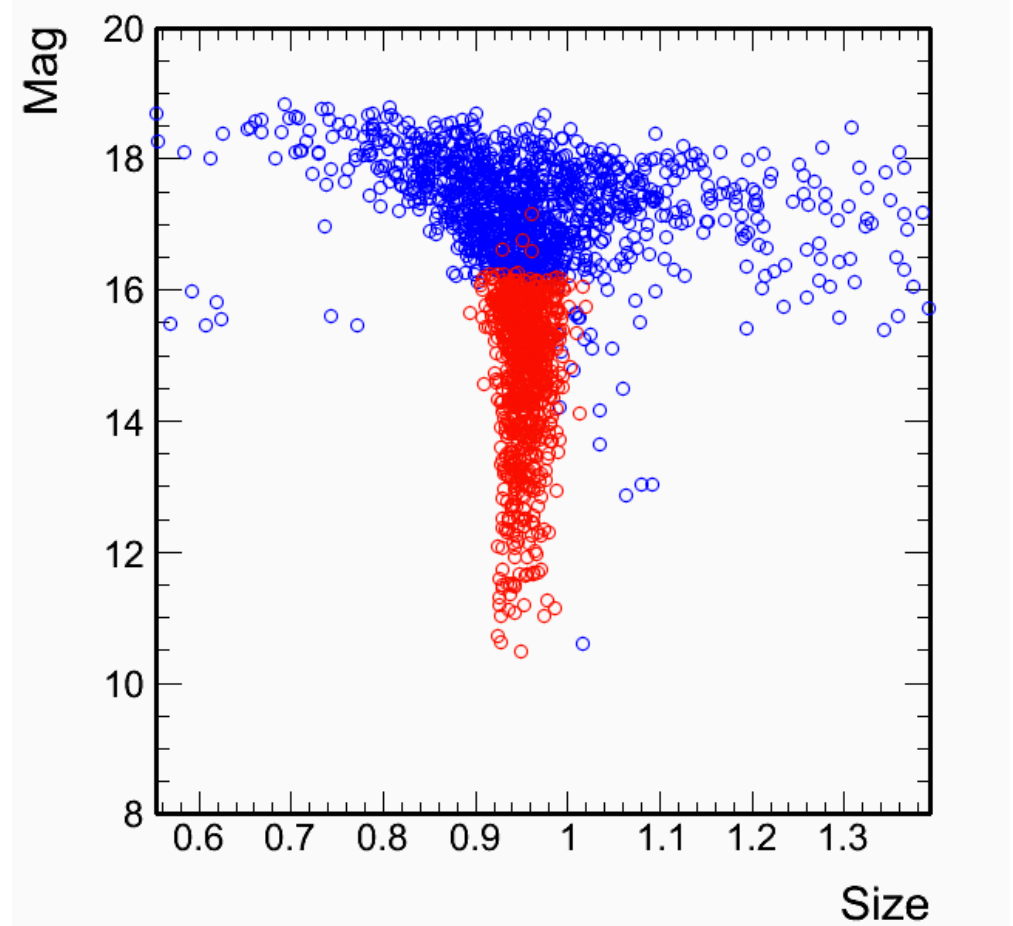




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# Star Selection

- Automated star selection in size magnitude plane for each CCD on every exposure to select bright stars.
- Algorithm quite robust
- Only keep  $S/N > 45$  objects

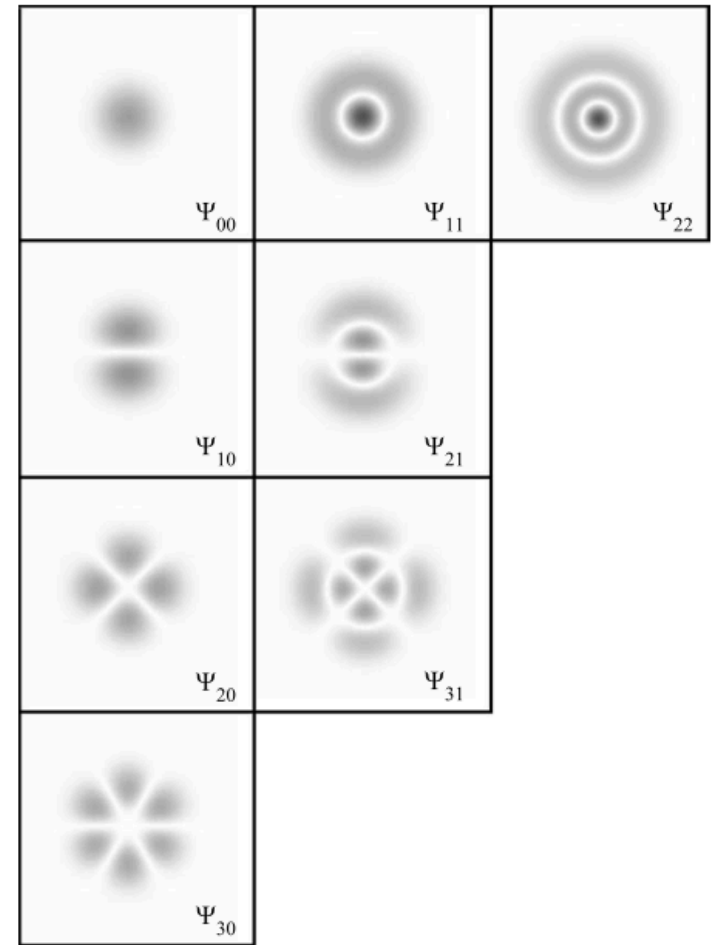




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# Shapelet Decomposition

- Do a shapelet decomposition for each star.
- Fit each shapelet coefficient with a 2<sup>nd</sup> order Legendre polynomial in X,Y across the CCD.
- Half of the stars are used to constrain the model and the other half are used to evaluate it.

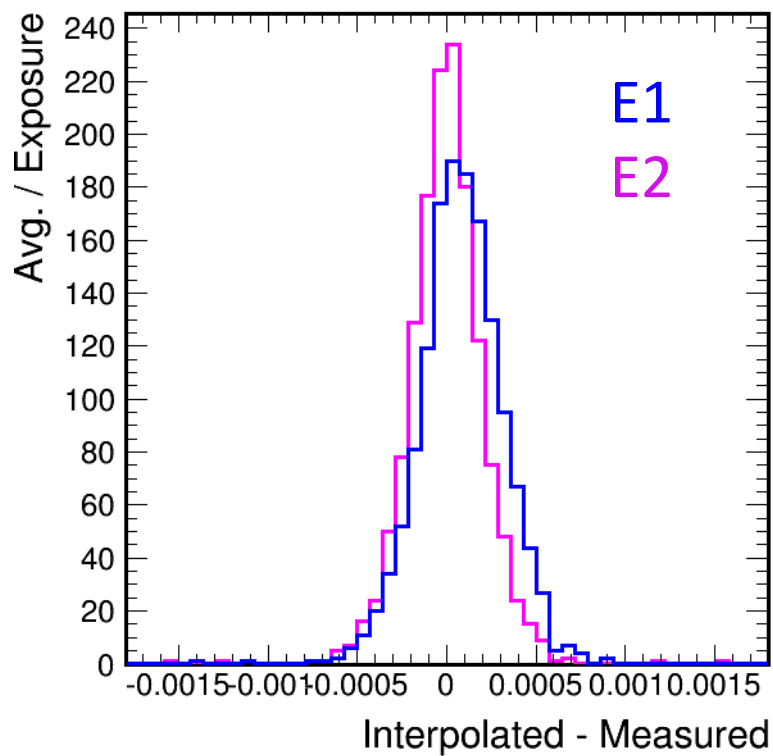




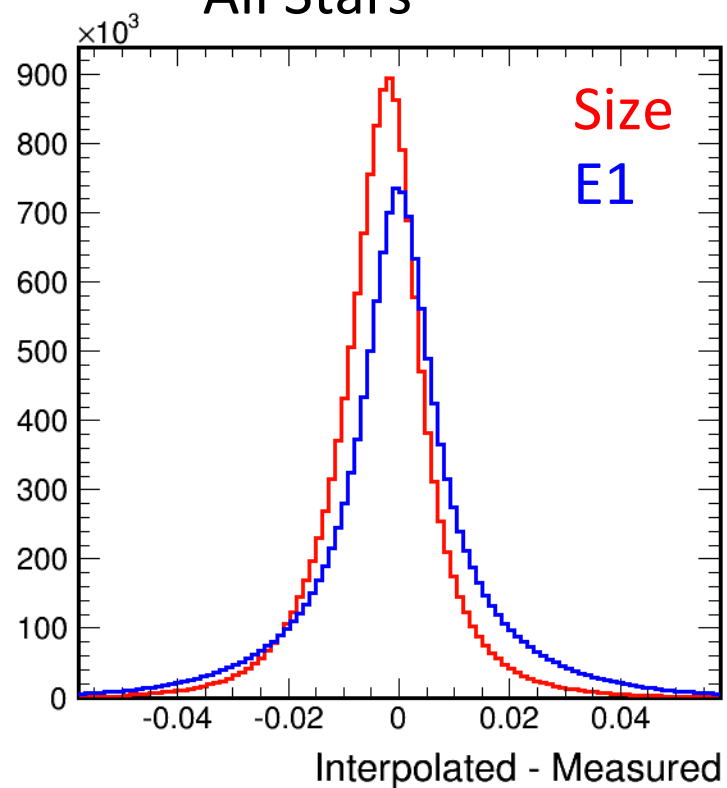
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# Residuals

## Per Exposure



## All Stars

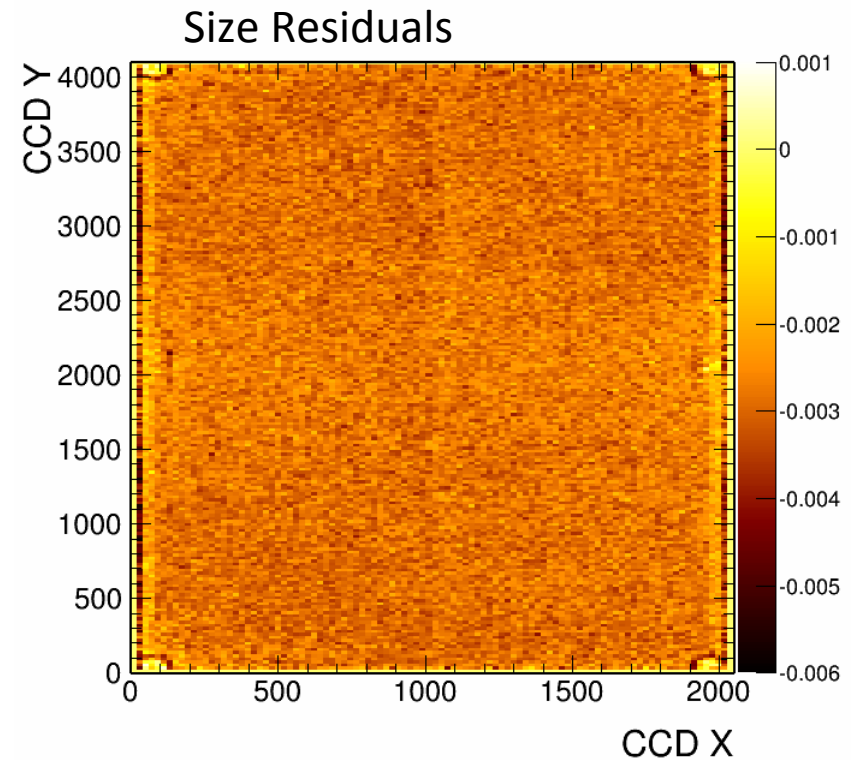
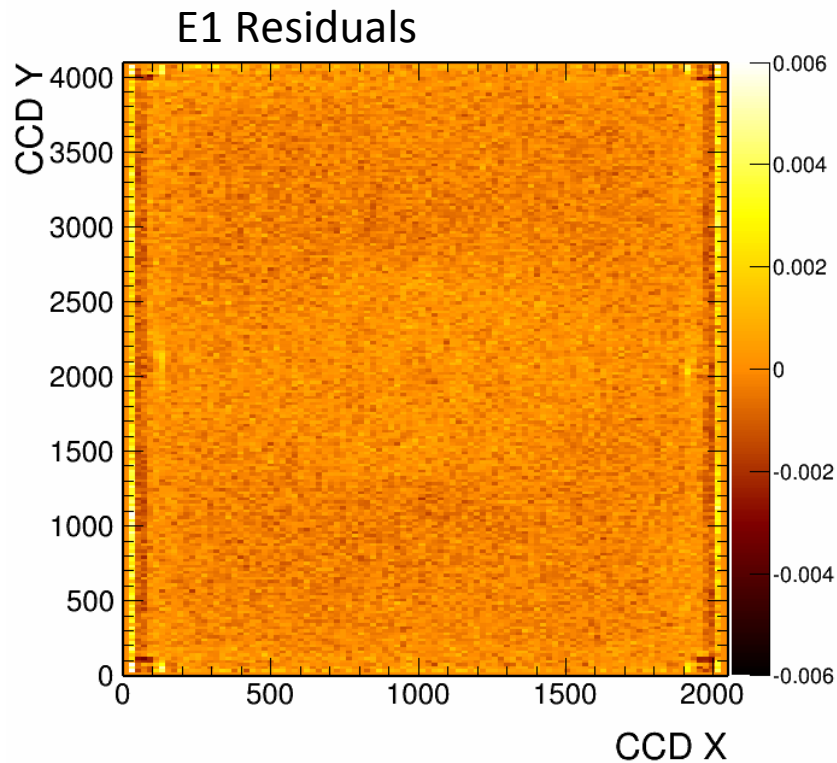




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# CCD Residuals

- Tape bumps and glowing edges visible.
- Not the best order polynomial

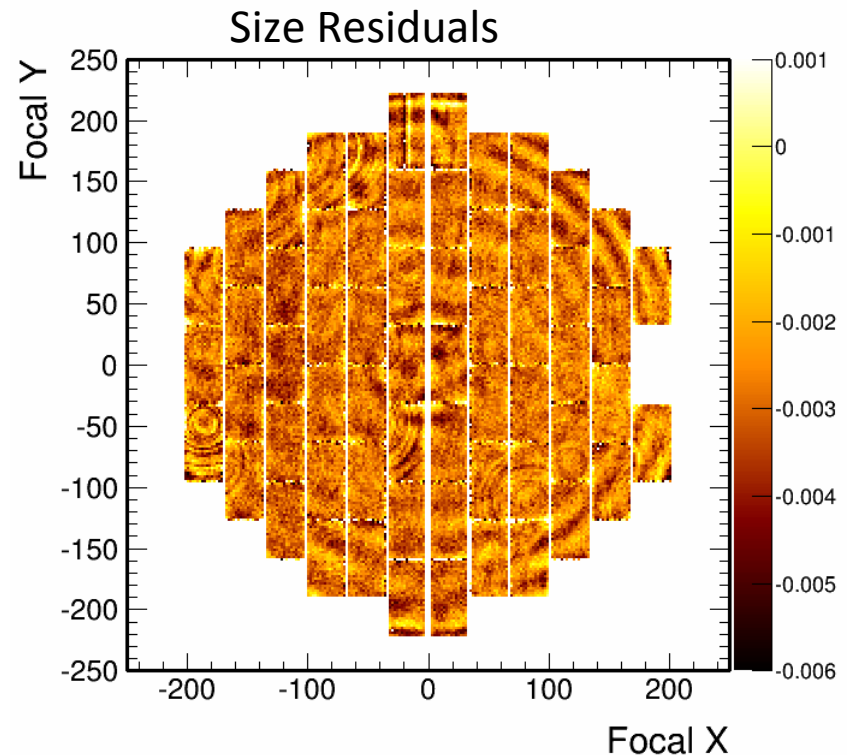
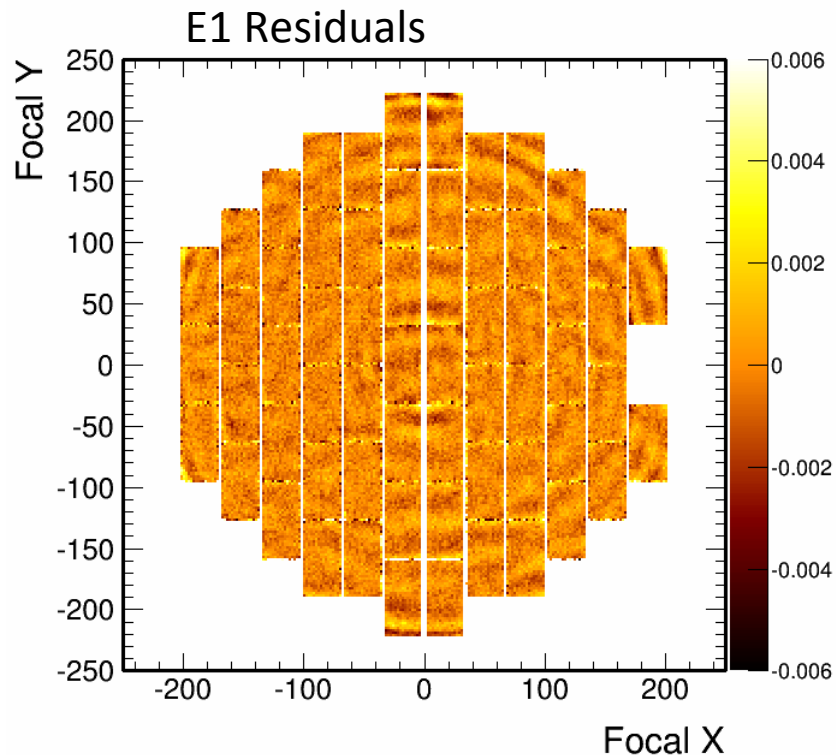




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# Focal Plane Residuals

- Radial pattern that is not well modeled – WCS?
- Tree rings are obvious for the size residuals.



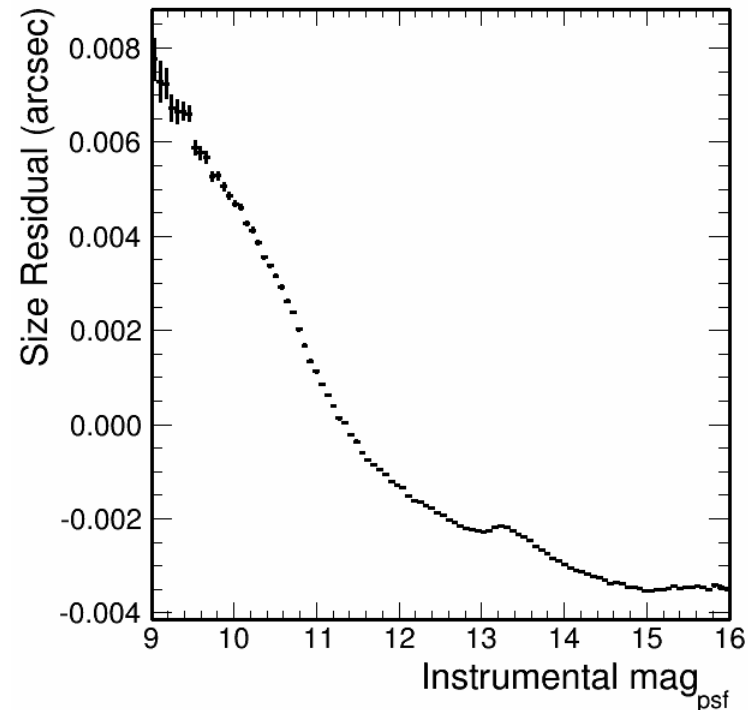
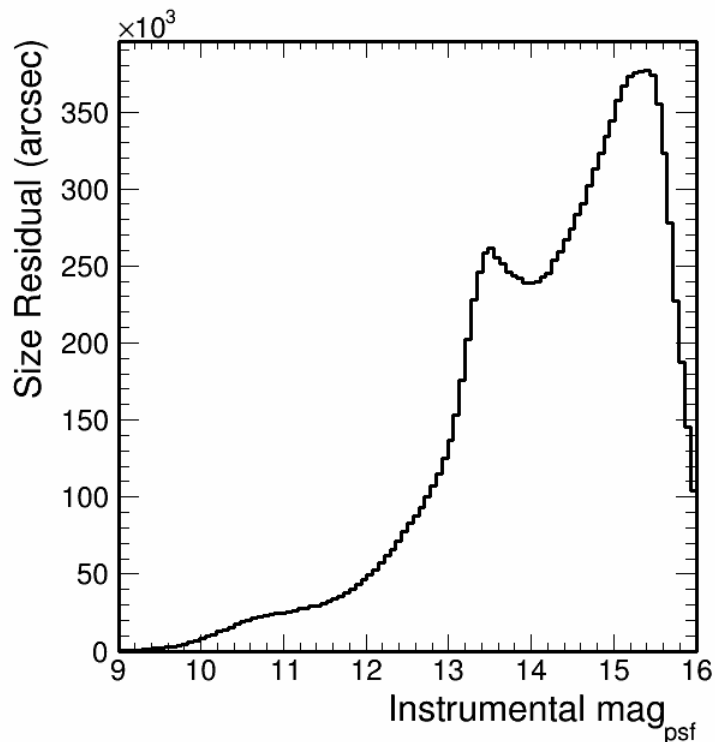




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# Brighter Fatter

- Brighter fatter effect causes the size residuals to be a function of magnitude.
- Interim solution – cut brightest 3 magnitudes out of analysis.
- Longer term option – correct for the effect. Gary showed results on this last meeting.

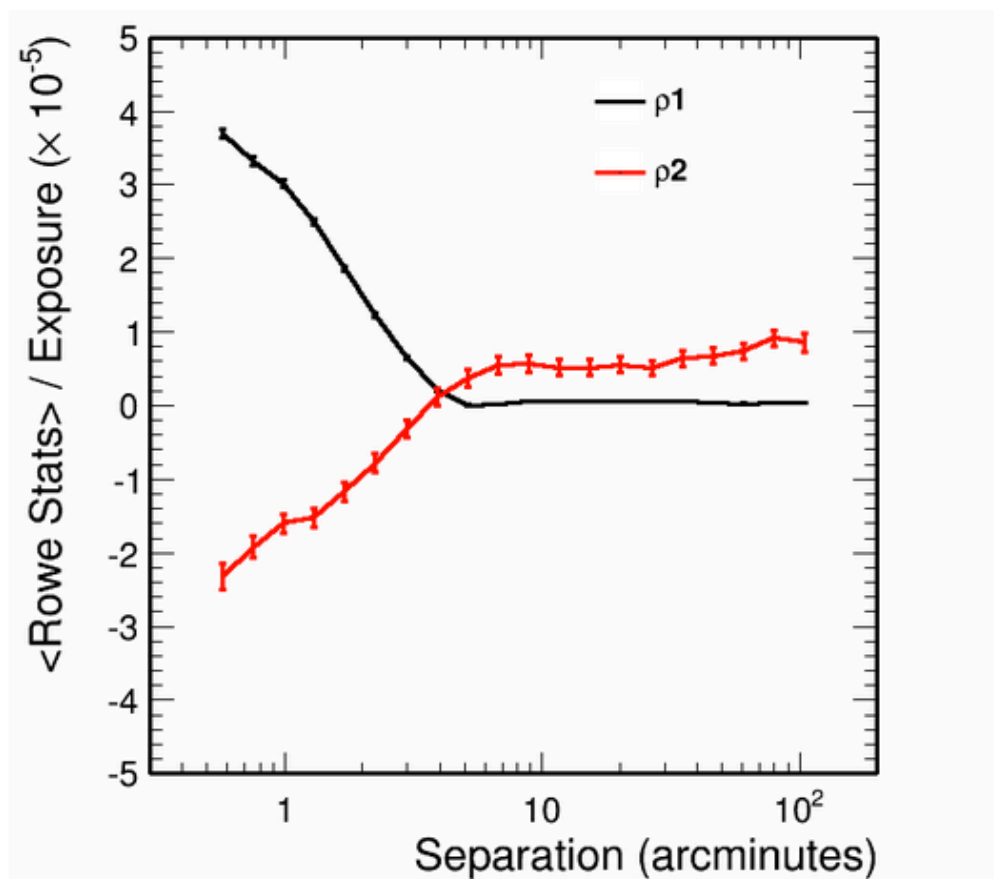




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# Rowe Stats

- Residual correlation
  - $\rho_1$  is the autocorrelation function of the ellipticity residuals
  - $\rho_2$  is the ellipticity-residual correlation function





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# Conclusions

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- PSF modeling shows a few percent effect due to detector effects.
- Current PSF models sufficient for Commissioning data science.
- Have methods to address these issues for first year DES data.